

**Missouri Department of Natural Resources  
Water Pollution Control Program**

**Total Maximum Daily Load (TMDL)**

**for**

**Little Muddy Creek**

**and**

**Tributary to Little Muddy Creek**

**Pettis County, Missouri**

**Completed December 6, 2000**

**Approved January 12, 2001**

**Total Maximum Daily Loads (TMDLs)  
For Little Muddy Creek  
and  
Tributary to Little Muddy Creek  
Pollutant: Temperature**

**Name: Little Muddy Creek**

Location: Near Sedalia in Pettis County, Missouri

Hydrologic Unit Code (HUC): 10300103-040003

Water Body # (WBID): 0856

Missouri Stream Class: C (Class C streams may cease to flow in dry periods but maintain permanent pools which support aquatic life.)<sup>1</sup>

Beneficial Uses: Livestock and Wildlife Watering, Protection of Aquatic Life and Human Health- Fish Consumption (Warm Water Fishery)

Size of Impaired Segment: 0.7 miles

Location of Impaired Segment: Wholly contained in NW ¼ Section 13, T46N, R22W

Pollutant: Temperature

Pollutant Source: Tyson Foods, Inc.

Permit Number: NPDES Permit No. MO-0115061

TMDL Priority Ranking: High

**Name: Tributary to Little Muddy Creek**

Location: Near Sedalia in Pettis County, Missouri

Water Body # (WBID): 3490

Missouri Stream Class: C (Class C streams may cease to flow in dry periods but maintain permanent pools which support aquatic life.)<sup>1</sup>

Beneficial Uses: Livestock and Wildlife Watering, Protection of Aquatic Life and Human Health- Fish Consumption (Warm Water Fishery)

Size of Impaired Segment: 0.4 miles

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<sup>1</sup> See 10 CSR 20-7.031(1)(F)

Location of Impaired Segment: The upstream end is in NE ¼ Section 14, T46N, R22W and the downstream end is in the NW ¼ Section 13, T46N, R22W

Pollutant: Temperature

Pollutant Source: Tyson Foods, Inc.

Permit Number: NPDES Permit No. MO-0115061

TMDL Priority Ranking: High

## **1. Background and Water Quality Problems**

These two streams lie approximately six miles northwest of Sedalia in Pettis County, Missouri. Little Muddy Creek (WBID#0856) is 7.3 miles in length and flows easterly into Muddy Creek, a tributary to the Lamine River. The classified section of the Tributary to Little Muddy Creek (WBID#3490) is 0.4 miles long. It enters Little Muddy Creek 0.7 miles upstream of Little Muddy's confluence with Muddy Creek. This tributary is also known as Tyson's Branch and will be referred to throughout this TMDL as the Tributary.

The source of the impairment is believed to be the Tyson Foods, Inc., poultry processing plant and the impairment is a violation of the water quality standard prohibiting a change in water temperature exceeding  $\pm 5^{\circ}$  Fahrenheit (See Specific Criteria on page 4). This facility is served by flow equalization, dissolved air floatation, anaerobic lagoons, and complete mixed activated sludge wastewater treatment units. It has a design flow of 3.88 cubic feet per second (cfs). The plant receives wastes from the slaughtering and processing of poultry and the water used in processing and clean up of work areas and equipment. The discharge is regulated by NPDES permit MO-0115061 which was issued in May, 1997, and expired in February, 2000. This permit is presently in the process of being reissued and requirements on effluent temperature are included. The new design flow will be 2.79 cfs. The difference in flow is due to calculating for a seven-day week compared to the former five-day week. Total discharge (gallons per week) is basically unchanged.

The discharge is located in the NW NW Section 23, T46N, R22W, in the headwaters of the tributary. From this point the discharge flows approximately one mile as an unclassified stream before reaching the 0.4-mile Class C stream segment (WBID 3490). There are no other point source discharges in this watershed.

A water quality study of Muddy Creek and selected tributaries was conducted by the Missouri Department of Conservation with laboratory support by the Missouri Department of Natural Resources (MDNR) between April, 1997 and April, 1998. One part of the study involved obtaining grab samples from the creeks. Temperature data from this part are found in the appendix with temperature shown in degrees Celsius ( $^{\circ}$  C). (Note that  $5^{\circ}$  F [degrees Fahrenheit] equals  $2.8^{\circ}$  C.) In another part of the study, temperature was recorded every thirty minutes using a continuous monitoring sampler. Due to the large amount of data generated, this information is not included in the appendix. It is on file with MDNR and available for review. The data from the grab samples show that water temperatures in the tributary exceeded those in Little Muddy

Creek upstream of the tributary by more than 5° F on 41 of 55 sampling dates. This represents a 74% exceedence rate of state water quality standards for water temperature. At comparable sites, continuous sampling temperature exceedences were 4042 out of 6890 samples or 58.7%. Water temperatures in Little Muddy Creek downstream of the tributary exceeded those in Little Muddy Creek upstream of the tributary by more than 5° F on 13 of 53 sampling dates for the grab samples and 2674 of 6891 for the continuous sampling. These represent respectively, 24.5% and 38.8% exceedence rates. EPA guidance for assessing beneficial use impairment suggests that any waters that have exceedence rates for conventional pollutants such as temperature in excess of 25% should be assessed as “not attaining” and exceedence rates of 10-25% should be assessed as only “partially attaining” the beneficial uses for which the standard applies. Exceedence rates less than 10% should be assessed as “fully attaining” beneficial use. Thus Missouri has designated 0.4 miles of the tributary and the lower 0.7 miles of Little Muddy Creek as not attaining the warmwater fisheries use.

The continuous sampling data indicated the water quality standard prohibiting an exceedence of 90° F for waters of the state was violated only once. There were no exceedences of the 90° F standard in the grab sampling data. This does not represent a water quality standard violation.

## **2. Description of the Applicable Water Quality Standards and Numeric Water Quality Targets**

### **Designated Uses**

The designated uses of Little Muddy Creek, WBID 0856, and its Tributary, WBID 3490, are Livestock and Wildlife Watering, Protection of Aquatic Life and Human Health- Fish Consumption (Warm Water Fishery). The stream classifications and designated uses may be found at 10 CSR20-7.031 (1)(C) and Table H.

### **Anti-degradation Policy**

Missouri’s Water Quality Standards include the EPA “three-tiered” approach to anti-degradation, and may be found at 10 CSR 20-7.031(2).

Tier I defines baseline conditions for all waters -- it requires that existing beneficial uses are protected. TMDLs would normally be based on this tier, assuring that numeric criteria (such as dissolved oxygen, ammonia) are met to protect uses.

Tier II requires no degradation of high-quality waters, unless limited lowering of quality is shown to be necessary for “economic and social development.” A clear implementation policy for this tier has not been developed, although if sufficient data on high-quality waters are available, TMDLs could be based on maintaining existing conditions, rather than the minimal Tier I criteria.

Tier III (the most stringent tier) applies to waters designated in the water quality standards as outstanding state and national resource waters; Tier III requires no degradation under any conditions. Management may require no discharge or prohibition of certain polluting activities. TMDLs would need to assure no measurable increase in pollutant loading.

This TMDL will result in the protection of existing beneficial uses, which conforms to Missouri's Tier I anti-degradation policy.

### **Specific Criteria**

The specific criteria for temperature are found in Missouri's Water Quality Standards, 10 CSR 20-7.031 (4)(D). There it states:

Water contaminant sources or physical alteration of the stream shall not raise or lower the water temperature more than 5° F [2.8° C], or contribute to a stream temperature in excess of 90° F [32° C].

The thermal mixing zone standard<sup>2</sup> was written for large streams and rivers and does not apply to this small tributary. Since there is no mixing zone to consider, the above criteria are applied at the beginning of the classified portion of the Tributary (WBID 3490). This portion is approximately one mile downstream of Tyson Foods' outfall #001 (See map in appendix).

The numeric water quality target for this TMDL is the 5° F standard, cited above, applied at the beginning of the classified portion of the Tributary.

### **3. Calculation of Load Capacity**

Load capacity is defined as the maximum pollutant load that will still attain water quality standards. In this TMDL, the load capacity will be the 90° F standard and the  $\pm 5^\circ$  F standard applied at the beginning of the classified portion of the Tributary. These are included in the new NPDES permit and will become effective after an interim period to give the plant time to upgrade their facility. The compliance date will be specified in the permit.

### **4. Margin of Safety (MOS)**

The margin of safety is based on conservative assumptions made during the development of the TMDL. These assumptions are as follows: The receiving stream where the 5° F standard will apply is the Tributary. The compliance point is at the beginning of the classified portion. The monitoring sites for temperature compliance will be 1) in the Tributary at the beginning of the classified portion and 2) in Little Muddy Creek just upstream of its confluence with the Tributary. If the standard is met at these two points, then it will be met in the Little Muddy itself. A margin of safety is provided in the tributary downstream of the compliance point since the water continues to cool as it flows along. This MOS increases as water flows from the tributary into Little Muddy Creek.

Furthermore, since the Tributary is effluent dominated, the water quality is actually the Tyson effluent quality. This means that there is little uncertainty between the effluent limits and resultant water quality.

### **5. Load Allocation (Non-point Source Load)**

Any nonpoint source contribution to elevated temperatures in this tributary would have to be due to solar heating. The most likely reasons for increased solar heating would be: 1) clearing of the streambanks and resulting loss of riparian shade, or 2) culturally induced shoaling and widening of the stream which would increase the amount of solar insolation per unit volume of water, or 3) sampling one stream in a shaded location and the other in a sunny location.

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<sup>2</sup> 10 CSR20-7.031 (4)(D)6

Inspection of the Tributary and of Little Muddy Creek by MDNR staff indicates that a narrow band of trees is the dominant riparian vegetation, and appears to be present in relatively equal proportion in Little Muddy Creek and the Tributary. Likewise, the stream channel of the Tributary did not appear to be proportionately wider and shallower than Little Muddy Creek. Department of Conservation staff, who conducted the survey, state that the upstream Little Muddy Creek sampling site was a pool mostly exposed to sunlight and would have been at least as sunny, and possibly more, than the sampling sites on the tributary or downstream on Little Muddy Creek. All these observations lead to the conclusion that nonpoint sources do not appear to play a role in elevating the temperature of the tributary. Additionally, any solar contribution is considered insignificant compared to effluent domination. Therefore, the Load Allocation for all nonpoint sources is zero.

## **6. Waste Load Allocation (Point Source Loads)**

Tyson Foods, Inc. is the only point source load discharging to or impacting the impaired segments of these two water bodies. Since the Load Allocation is zero and the Margin of Safety is intrinsic, the Wasteload Allocation is identical to the Load Capacity. The Load Capacity will be Missouri's numeric criteria applied at the beginning of the classified portion of the Tributary. The criteria specify that water contaminant sources or physical alteration of the stream shall not raise or lower the water temperature more than 5° F [2.8° C], or contribute to a stream temperature in excess of 90° F [32° C].

## **7. Seasonal Variation**

The last 0.4 mile of the Tributary is classified as a Class C stream. This means it "may cease to flow in dry periods but maintains permanent pools which support aquatic life." The Tributary is dominated by the Tyson discharge which creates year round flow. The data indicate that the 90° F standard was only exceeded only once in the summer months (June-August) and the largest number of exceedences of the 5° F standard occurred in November. This information could be interpreted to mean there is a seasonal component to this impairment. Missouri does not, however, have separate temperature standards for summer and winter (see specific criteria above).

## **8. Implementation and Monitoring Plans for TMDL under the Phased Approach**

Tyson Foods' NPDES permit (#MO0115061) is being reissued with interim effluent limits which become effective upon issuance and remain in effect for two years. At that time, the temperature requirements (see Specific Criteria) become effective. Daily temperature monitoring by the plant is also included in the permit, with monitoring reports to be submitted monthly. The monitoring sites are in the Tributary near the beginning of the classified portion and in Little Muddy Creek just upstream of the Tributary's confluence (see Appendix B). All Missouri TMDLs are phased. If future monitoring reports reveal that water quality standards are not being met, this TMDL will be re-opened and re-evaluated. This TMDL will be incorporated into Missouri's Water Quality Management Plan.

## **9. Reasonable Assurances**

The Department of Natural Resources has the authority to write and enforce NPDES permits. Inclusion of effluent limits into a state NPDES permit and daily monitoring with monthly reports should provide reasonable assurance that instream water quality standards will be met.

## **10. Public Participation**

These water quality limited segments are included on the approved 1998 303(d) list for Missouri. The MDNR Water Pollution Control Program developed this TMDL. A public notice period was held from Oct. 27 to Nov. 26, 2000. Groups receiving the public notice announcement included the Missouri Clean Water Commission, the affected facility, the Water Quality Coordinating Committee, the TMDL Policy Advisory Committee, Stream Team volunteers in the watershed, and others that routinely receive the public notice of NPDES permits. Comments were received from Tyson Foods, Inc., Sierra Club and Missouri Department of Conservation. Some adjustments were made to the TMDL document in response to comments received, but the overall approach and the numeric targets remain unchanged. Copies of the notice, the comments and MDNR's response to the comments are on file with MDNR.

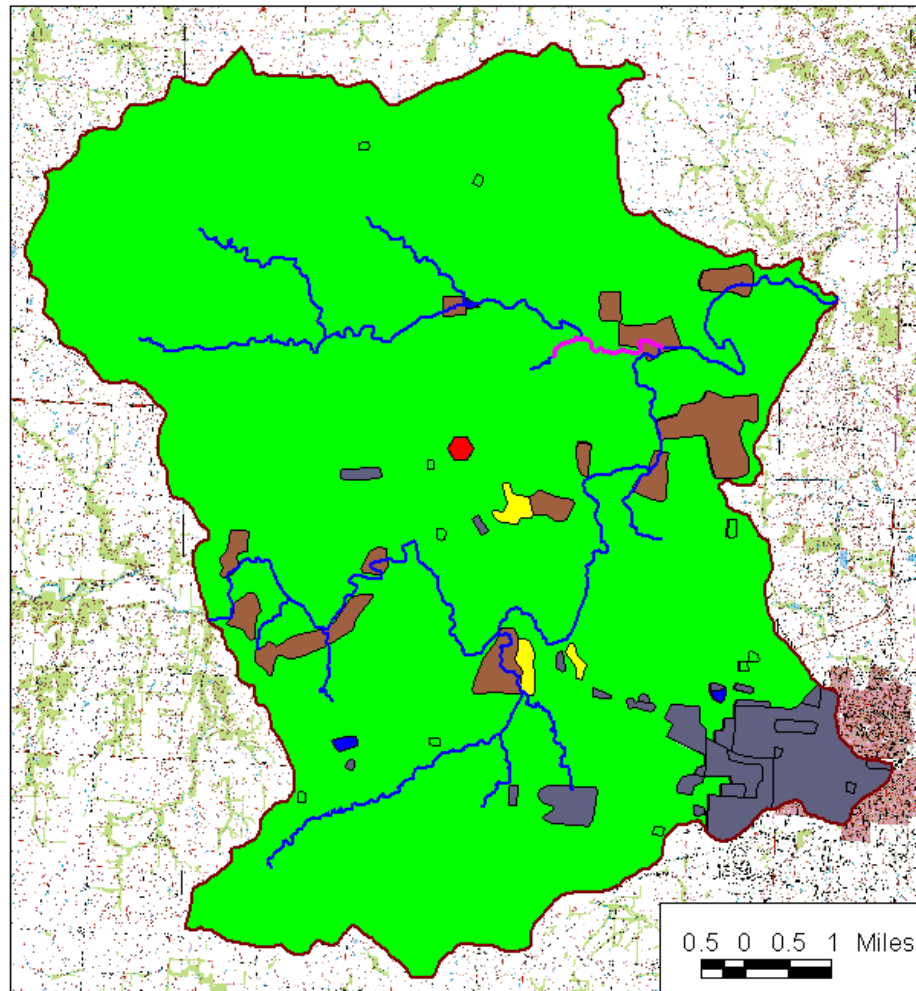
## **11. Appendices and List of Documents on File with MDNR**

Appendix A – Land Use Types for the Little Muddy Creek Watershed  
Appendix B – Map of Sample Locations and Impaired Stream Segment  
Appendix C – Grab Sample Temperature Data (April, 1997-April, 1998)

Documents on file with MDNR:

The permit for Tyson Foods, Inc: NPDES Permit No. MO-0115061  
Continuous sampling temperature data (June, 1997-January, 1998)  
Missouri Department of Conservation Memorandum summarizing the continuous sampling data  
Public Notice announcement  
Public comments  
MDNR's response to public comments

## Appendix A Land Use Types for Little Muddy Creek Watershed (10300103-040003)



Land Use Type		Area (acres)
Urban or Built-up Land		1858
Residential	1101	
Commercial and Services	451	
Industrial	93	
Trans, Comm, Util	7	
Other Urban or Built-up	206	
Agricultural Land		37626
Cropland and Pasture	37556	
Confined Feeding Ops	5	
Other Agricultural Land	65	
Forest Land		1484
Deciduous Forest Land	1034	
Mixed Forest Land	450	
Water		42
Lakes	7	
Reservoirs	35	
Barren Land		168
Strip Mines	168	

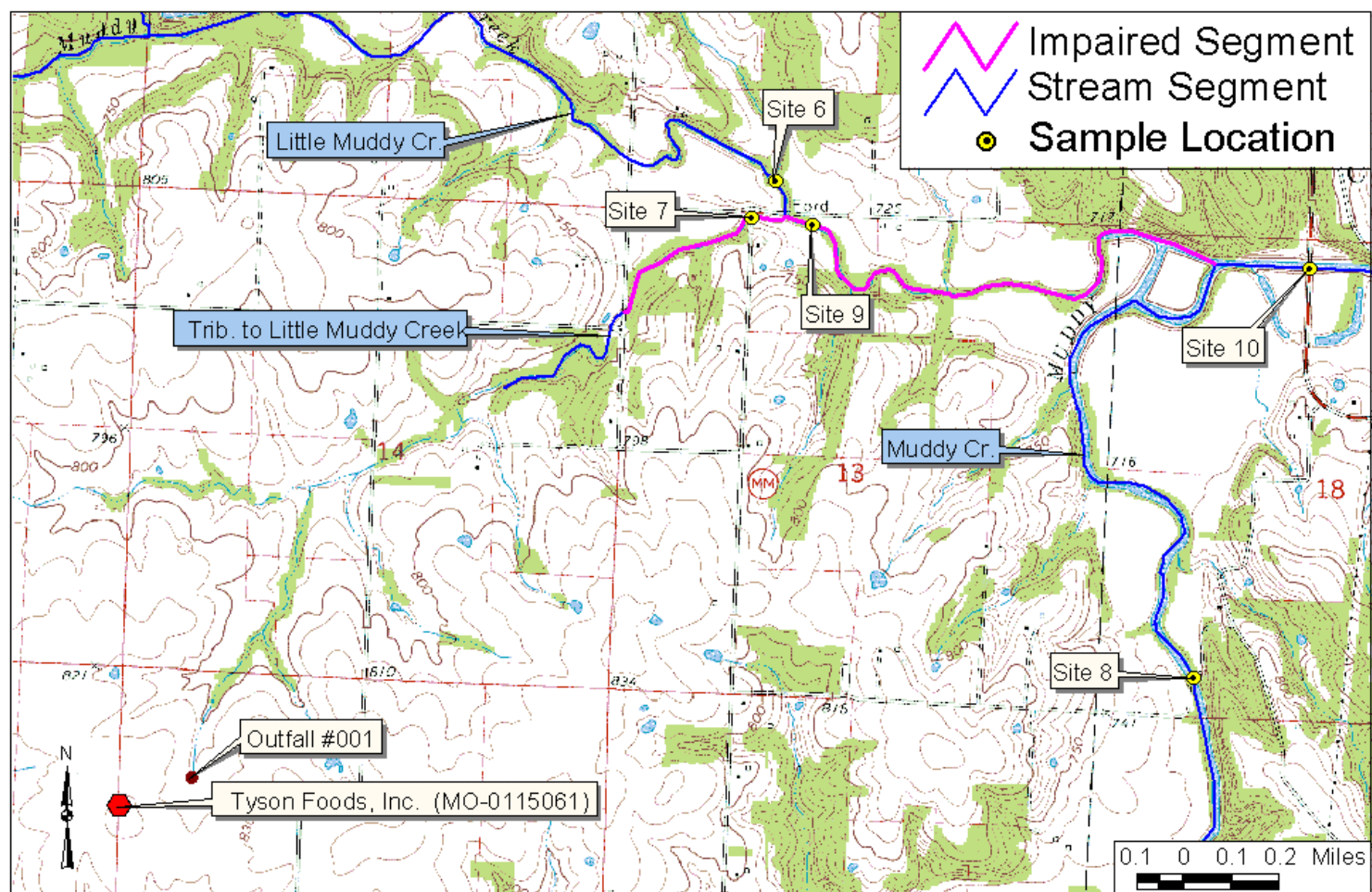
- Tyson Foods, Inc.
- Impaired Segment
- Stream Segment



- Watershed Landuse
- Urban or Built-up Land
  - Agricultural Land
  - Rangeland
  - Forest Land
  - Water
  - Wetland
  - Barren Land
  - Tundra
  - Perennial Snow or Ice



## Appendix B. Map of Sample Locations and Impaired Stream Segments Little Muddy Creek, Pettis County, Missouri



## Appendix C

### Grab Sample Temperature Data (April, 1997-April, 1998) From Sites on Tributary to Little Muddy Creek, Little Muddy Creek and Muddy Creek

			SITE8	SITE9	SITE6	SITE7	SITE10
TEMPERATURE	12-2-97		8.3	10.6	7.2	20.6	8.9
TEMPERATURE	12-4-97		5.6	5.6	5.6	15.6	6.7
TEMPERATURE	12-11-97		3	8.3	1.9	12.8	3.1
TEMPERATURE	12-12-97		2.2	3.6	2.1	14.5	2.3
TEMPERATURE	12-15-97		3.2	6.6	2.2	17	2.3
TEMPERATURE	12-22-97		3	2.8	2.5	12	3
TEMPERATURE	12-30-97						
TEMPERATURE	12-31-97						
TEMPERATURE	1-08-98		3.3	3	2.6	5.9	3.5
TEMPERATURE	1-09-98		2.4	2.3	2.3	8.6	1.9
TEMPERATURE	1-20-98		2.6	6.9	3.6	12.9	2.5
TEMPERATURE	1-22-98		2.6	6.9	3.1	13.2	2.7
TEMPERATURE	1-26-98		4.8	10.3	6.1	17.9	5.5
TEMPERATURE	1-30-98		4.4	8.7	6.3	14.9	5.3
TEMPERATURE	2-2-98		6	10	7.9	13.7	5.3
TEMPERATURE	2-3-98		4.9	9.2	4.1	15.5	5.7
TEMPERATURE	2-9-98		5.3	9.9	6.9	17.5	5.7
TEMPERATURE	2-18-98		5.2	5.1	5.9	10.7	5.3
TEMPERATURE	2-20-98		5.6	7	6.1	12	6
TEMPERATURE	2-25-98		9.8	13.7	10.7	18.2	10.1
TEMPERATURE	2-26-98		10.2	12.1	11	17.7	10.7
		winter avg	4.86	7.51	5.16	14.27	5.08
TEMPERATURE	3-2-98		4.5	7.7	5.2	14.6	4.8
TEMPERATURE	3-12-98		0.7	2.7	2.7	10.2	1.2
TEMPERATURE	3-19-98						
TEMPERATURE	3-20-98		2.9	2.8	1.9	7	3.5
TEMPERATURE	3-24-98		6.6	11	7.6	16.6	8.5
TEMPERATURE	3-26-98		13.5	16.5	15	22	12.5
TEMPERATURE	3-30-98		17	19	18	23.5	17.5
TEMPERATURE	4-3-98		11.1	11.8	11.2	15.6	11.2
TEMPERATURE	4-8-98		11.7	11.9	11.8	15.1	12.1
TEMPERATURE	4-10-98		10.3	12.3	10.7	17	10.5
TEMPERATURE	4-15-98		15.1	15.4	14.8	15.4	18
TEMPERATURE	4-17-98		12	12.4	11.8	19.7	11.5
TEMPERATURE	4-21-97		14	13			14
TEMPERATURE	4-28-97		15	15			15
TEMPERATURE	5-6-97		18	19			17
TEMPERATURE	5-15-97		15.9	16.6	16.2	17.2	15.3
TEMPERATURE	5-20-97		16.7	17.4	17.6	15.6	17.8
TEMPERATURE	5-25-97		22.8	22.9	22.7	26.2	21.9
TEMPERATURE	5-28-97				14.4	18.0	14.4
TEMPERATURE	5-31-97		16.5	16.5	16.8	23.1	17.9
		spring avg	12.5	13.55	12.4	17.3	12.9
TEMPERATURE	6-5-97		20.9	20.5	22.9	28.1	19.4
TEMPERATURE	6-8-97		20.5	20.7	19.9	24.0	22.1
TEMPERATURE	6-11-97		20.8	21.9	22.1	25.7	21.5
TEMPERATURE	6-16-97		22.5	21.4	21	24.7	22.2
TEMPERATURE	6-21-97		25.1	25.1	25.0	27.1	24.8

TEMPERATURE	6-26-97		27.1	28.6	24.4	22.4	24.6
TEMPERATURE	7-1-97		23.6	25.0	25.1	25.2	27.9
TEMPERATURE	7-9-97		24.9	23.9	23.2	25.6	27.1
TEMPERATURE	7-17-97		27.1	26.8	27.4	29.5	27.0
TEMPERATURE	7-27-97		28.3	26.9	29.1	29.8	27.2
TEMPERATURE	7-31-97		23.3	21.7	22.8	24.4	22.5
TEMPERATURE	8-5-97		24.6	23.8	25.7	26.3	24.5
TEMPERATURE	8-11-97		23.4				24.6
TEMPERATURE	8-15-97		23.5	23.4	23.2	26.5	23.8
TEMPERATURE	8-24-97		23.5	23.3	24.6	26	21.2
		summer avg	23.94	23.79	24.03	26.09	24.03
TEMPERATURE	9-3-97		22.8	22.7			20.5
TEMPERATURE	9-8-97						
TEMPERATURE	9-17-97		24.2	24.7	25.9	26.8	23
TEMPERATURE	9-21-97		20.9	20.2			19.8
TEMPERATURE	10-14-97		13.9	13.2	12.8	19.9	14.7
TEMPERATURE	10-21-97		12.4	13.9		19.9	11.7
TEMPERATURE	10-30-97		10.3	14	10.6	18.8	10.9
TEMPERATURE	11-3-97		7.7	9.1	7.7	13.8	7.8
TEMPERATURE	11-10-97		7.2	11.6	7.6	16.9	6.9
TEMPERATURE	11-12-97		7.1	10.8		18.2	4.9
TEMPERATURE	11-19-97		5.7	11.9		17.6	5.7
TEMPERATURE	11-20-97		5.5	12.6		18	5.9
TEMPERATURE	11-24-97		7.9	12.9	6.7	19.8	7.7
		fall avg	12.13	14.8	11.88	18.97	11.63
		spring avg	12.46	13.55	12.4	17.3	12.9
		summer	23.94	23.79	24.03	26.09	24.03
		fall avg	12.13	14.8	11.88	18.97	11.63
		winter avg	4.86	7.51	5.16	14.27	5.08